CONSTRUCTING SMOOTH PAVEMENTS

India has the second largest network of roads in the world. It is, however, also known for its poor roads. One of the elements by which the public evaluates the quality of roads is the smoothness of pavements, for both the newly constructed and rehabilitated pavements. Our roads primarily lack this smoothness characteristic and, therefore, perception of the public is that our roads are bad. Smoothness of riding surface is known to establish the roadway quality, ever since the first pavement was built and it is still true today. The sensitivity of smoothness has increased over the years because smoothness of a road is more relevant to a road network catering to heavily loaded vehicles like trucks etc. desiring to travel at high speeds. Similarly, the highway users' expectations for smoothness will increase in future.

Federal Highway Administration, USA had conducted a national user survey in 1996 and the survey revealed that only 53% of users were satisfied with the pavement systems that exist in USA. A subsequent survey in 2000 was again conducted by Federal Highway Administration and it was found that level of satisfaction had grown to 67%. The need to construct smooth pavements in India hardly needs emphasis, if highway agencies have to get a better acceptance of their performance by the road users/public. Achieving a smooth surface requires a strong commitment on behalf of both the contractor and highway agencies. Many factors are required to be strictly controlled, including the provisions in specifications because such factors can influence the riding surface.

Initial pavement smoothness directly affects the long term performance of the pavements. Research conducted in this regard in developed countries have broadly established the fact that if the pavements are constructed with higher initial smoothness then such pavements last longer than those pavements whose initial roughness is more. This is significantly true in case of new concrete pavements. In USA the failure analysis of over 140 nos. of concrete pavement projects scattered in 11 States ranging from 7 to 37 years in service had been conducted and the results speak that substantial extension of service life was obtained if the smoothness is increased. California profilograph data revealed that the extension in the service life of smoother pavements can be achieved to the extent of 25%.

Historically, smoothness requirements were initially kept quite low in view of non-availability of modern compactors & other equipments with the result that resulting surfaces were non-uniform and inconsistent. The riding smoothness was determined by straight edge to detect bumps etc. in pavements. Straight edge method provides an adequate control for pavement widths between 3.6 m to 5.5 m. With the induction of modern paving machines for bituminous work and slip form paver for concrete roads, higher outputs are obtained as they are producing mixes and concrete between 150 to 250 cum per hour. It is very difficult to keep control on the smoothness requirements in case of such modern projects by using straight edge method. Specifications must adjust to the requirements by providing the use of some kind of faster means like profilographs etc.

In order to achieve smoother pavements, it is considered desirable to induct reasonable monetary incentives to the contractors who are willing to achieve smoothness higher than those prescribed in the specifications. The present method of 'accept and reject criteria' is not going to produce more smooth pavements because there is no incentive for producing it. It is a certain fact validated through historical data base, that unless the highway agencies are willing to provide monetary incentives contractors will somehow settle for achieving the level of smoothness which will ensure them 100% payment. An incentive system which includes deducting the payment with lower quality of smoothness (well above the rejected quality level) and higher rewards to the extent of 105 to 107% payment will not only lead to construction of more smooth pavements but will also induct competitiveness in the bidding process under which better performing contractors will lower their unit price for paving and will compensate the same through incentive. In the long run, this will induct purchase of new machines/equipments by the contractors to achieve better smoothness of the pavements than specified. This needs to be considered seriously by highway agencies of India.

Roughness cannot be achieved without adopting the integrated approach. The steps should be initiated in design stage by prescribing more stringent specifications of the pavement. Design features like base type, base width, track line, vertical and horizontal alignment, grades, quality of bituminous mix or concrete mix as the case may be, can impact the degree of smoothness which can possibly be achieved. Unless we make suitable specifications and design features in respect of the above factors, it will not be possible to achieve the desired level of smoothness of the pavement, even if, modern paving equipment and a skilled crew are used in the construction process. One area of possible improvement is to specify and enforce lower tolerances for design features. This will remarkably improve the pavement smoothness potential.

One of the significant steps required in case of concrete pavements is to provide an extra width of prepared sub-bas/base layer, beyond the edge of the pavement lane. We need not be money saver by reducing or eliminating this extra width requirement because, such extra width provides more efficient and stable functioning of the track line of a slip form paver. Extending the prepared sub-base layer (DLC) also contributes to edge support, which prevents settlement of shoulders or curve and gutter sections. Highway agencies should consider this suitable improvement in the existing specifications i.e. the base/sub-base (DLC) should extend beyond the edge of pavement lane by 1 m on each side. The extra cost is worth.

Stability of sub-base is another important design consideration and needs attention of highway agencies in the country. Dense graded granular material or material stabilized with cement and asphalt provides firm support for construction equipment. There is a need to achieve appropriate balance between the degree of drainage and the stability of sub-base layer. Sub-base stability should not be sacrificed for the sake of drainage. Recently, many specifications have preferred to provide unstabilized permeable layers to achieve better drainage. A target range between 60 to 90 m/day may produce a stable draining layer. Necessary changes in the specifications may be made to ensure that adequate stability and draining properties of such layers are available to ensure construction of smooth and long lasting smooth pavements.

(V.K. Sinha)
Secretary General